US005549356A

United States Patent [19]

Gray

[11] **Patent Number: 5,549,356**

[45] **Date of Patent: Aug. 27, 1996**

[54] CHILD RESTRAINT SYSTEM

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[73] Assignee: **TRW Vehicle Safety Systems Inc.**, Lyndhurst, Ohio

[21] Appl. No.: **327,022**

[22] Filed: **Oct. 21, 1994**

[51] **Int. Cl.**[6] **B60N 2/28**

[52] **U.S. Cl.** **297/256.15**; 297/467; 297/484

[58] **Field of Search** 297/256.15, 484, 297/467, 256.1

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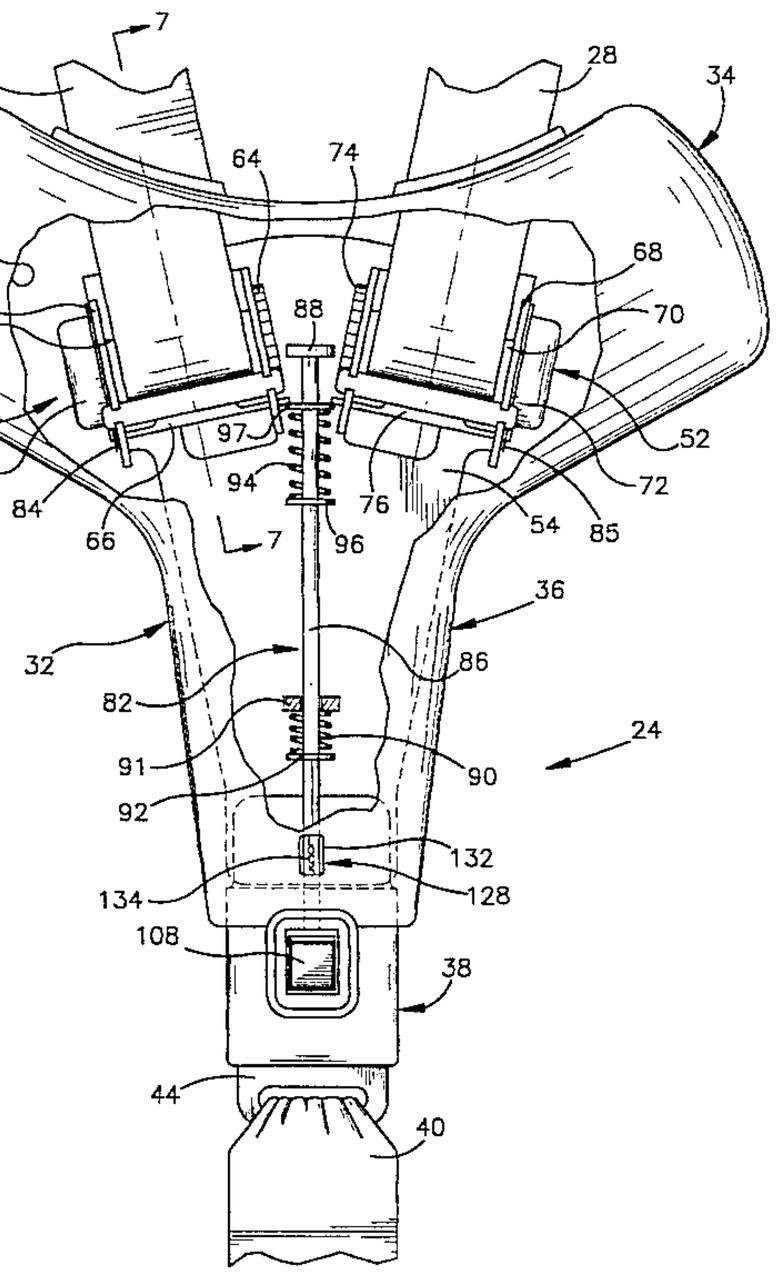
Primary Examiner—Peter M. Cuomo
Assistant Examiner—David E. Allred
Attorney, Agent, or Firm—Tarolli, Sundheim, Covell, Tummino & Szabo

[57] **ABSTRACT**

A child restraint system (**24**) includes shoulder belts (**26**) and **28** which engage the shoulders of a child (**12**) seated in a vehicle. The shoulder belts (**26**) and (**28**) are connected with an abdomen shield (**32**). A buckle (**38**) connects the shield (**32**) with a base (**16**) of a seat (**14**). A pair of retractor assemblies (**50**) and (**52**) are mounted in the abdomen shield (**32**) to enable the shoulder belts (**26**) and (**28**) to be extended upon movement of the abdomen shield (**32**) away from the child (**12**) seated in the vehicle. Upon movement of the abdomen shield (**32**) toward the child (**12**) seated in the vehicle, the retractor assemblies (**50**) and (**52**) retract the shoulder belts (**26**) and (**28**). The retractor assemblies (**50**) and (**52**) include spools (**60**) and (**70**) upon which the shoulder belts (**26**) and (**28**) are wound during retraction of the shoulder belts and unwound during extension of the shoulder belts. Latch pawls (**66**) and (**76**) are engageable with ratchet wheels (**64**) and (**74**) connected to the spools (**60**) and (**70**) to lock the spools against extension of the shoulder belts (**26**) and (**28**) when the shield (**32**) is buckled to the base (**16**). Unbuckling of the abdomen shield (**32**) from the base (**16**) results in the latch pawls (**66**) and (**76**) being disengaged from the ratchet wheels (**64**) and (**74**) to enable the shoulder belts (**26**) and (**28**) to be freely extended. An actuator assembly (**82**) causes the latch pawls (**66**) and (**76**) to be disengaged from the ratchet wheels (**64**) and (**74**).

14 Claims, 4 Drawing Sheets



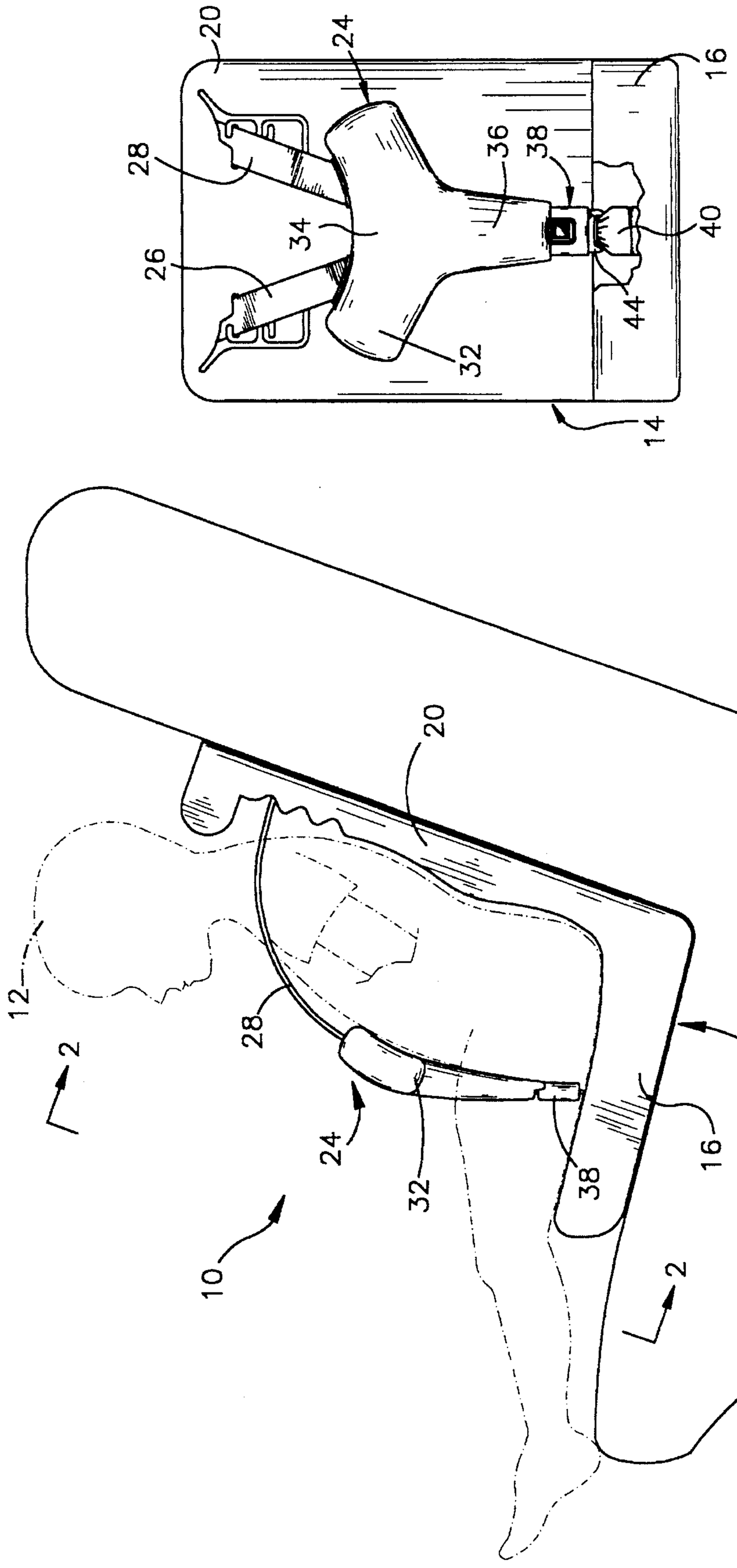


Fig.2

Fig.1

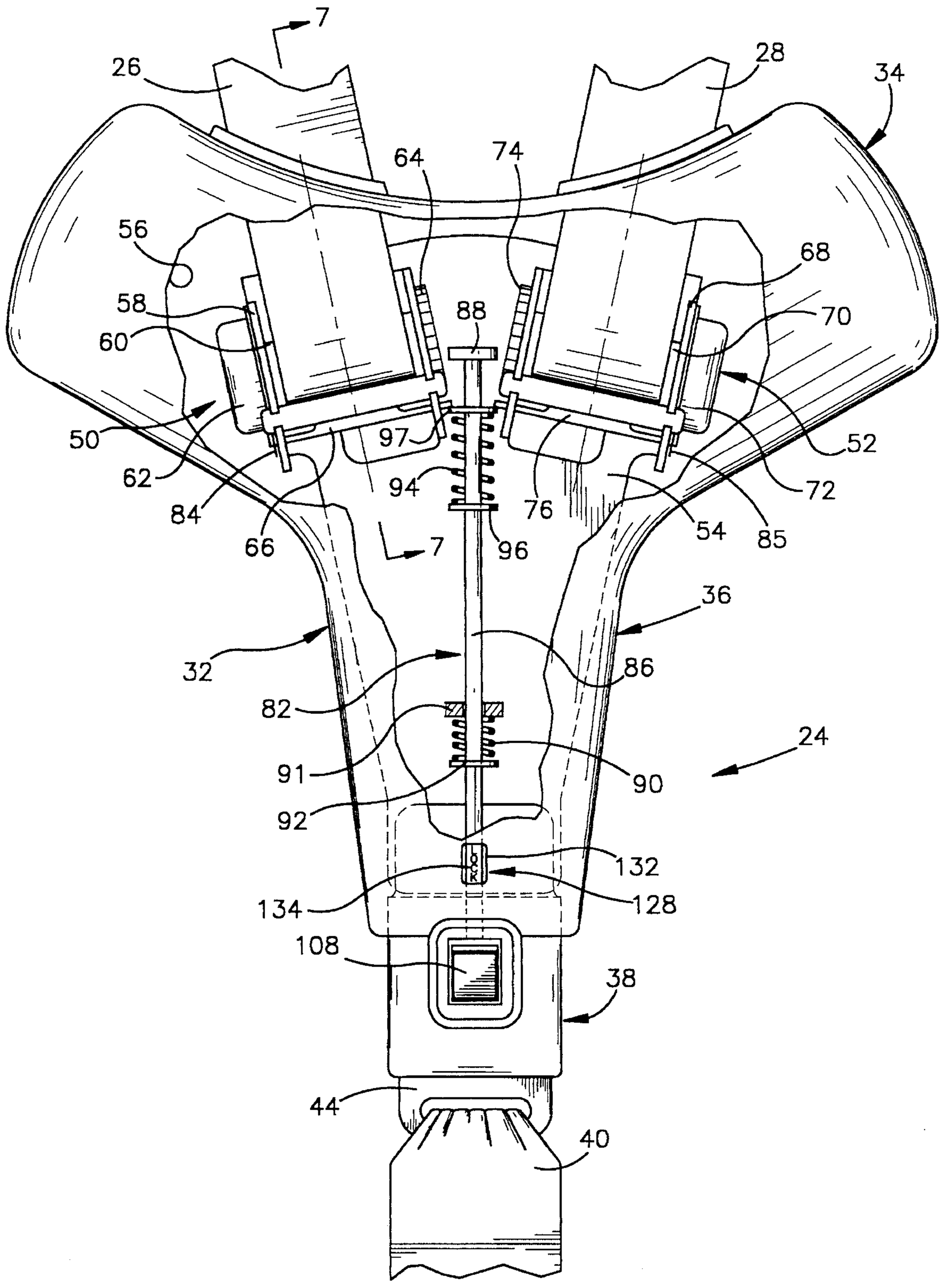

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Fig.3

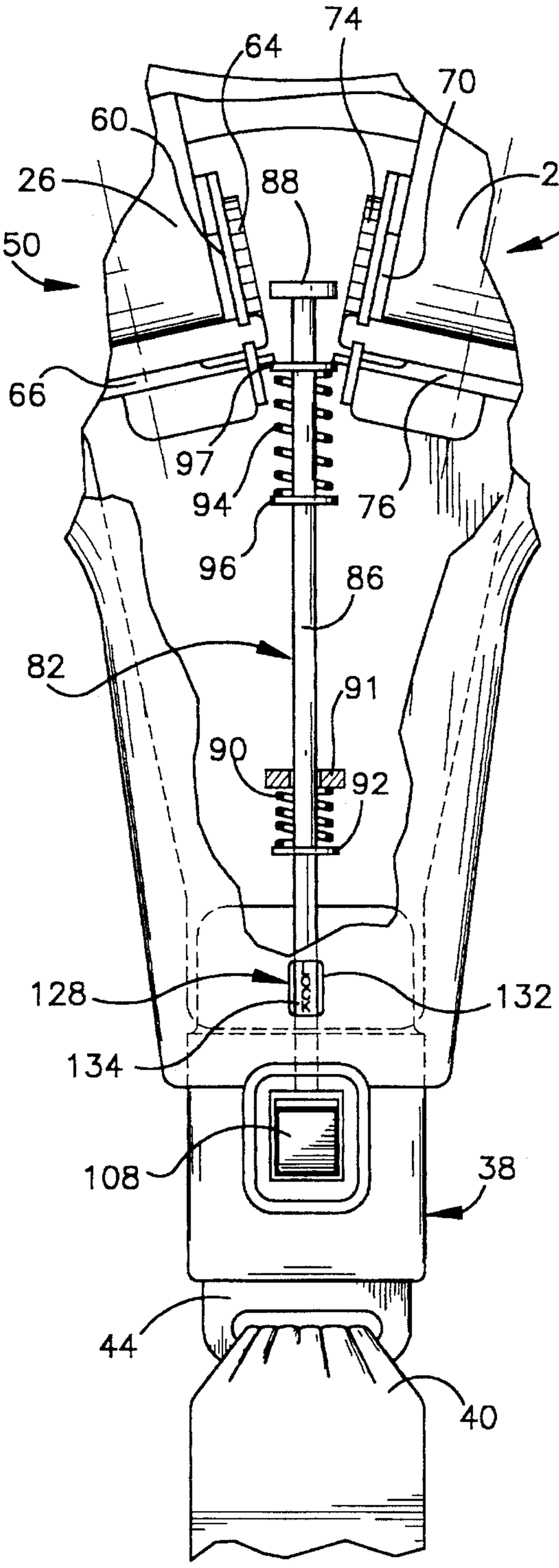
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Fig.4

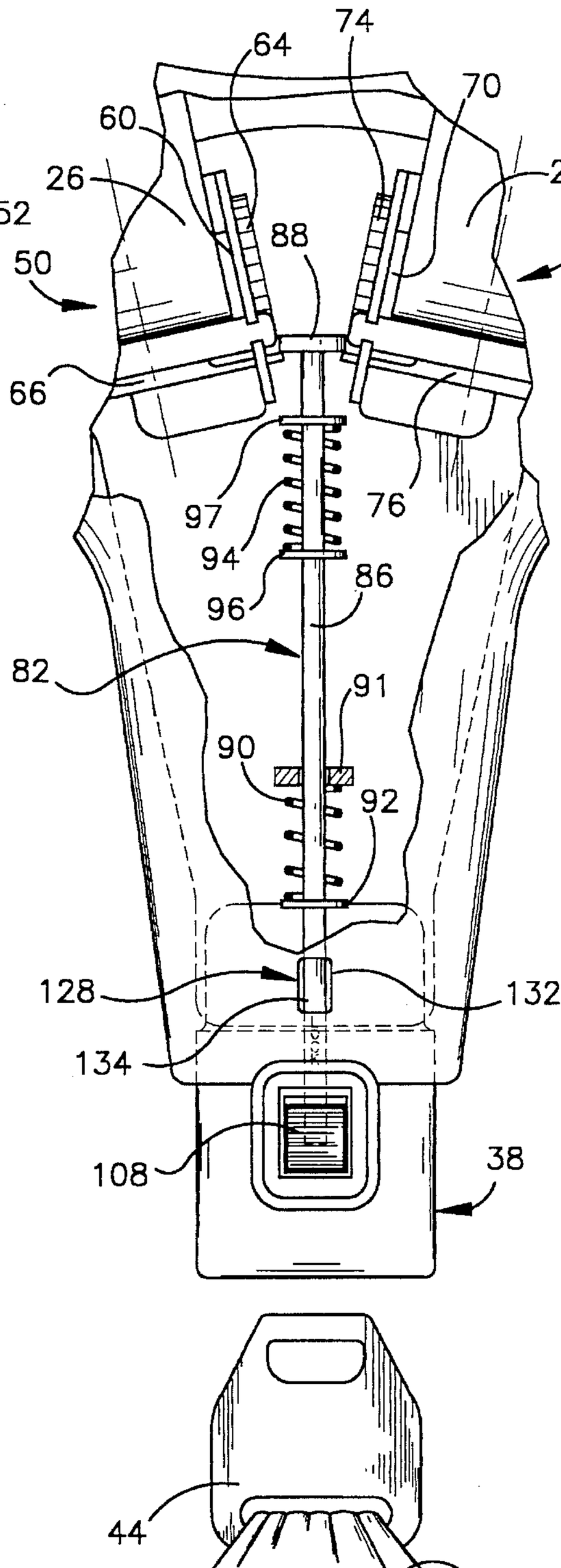
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Fig.5

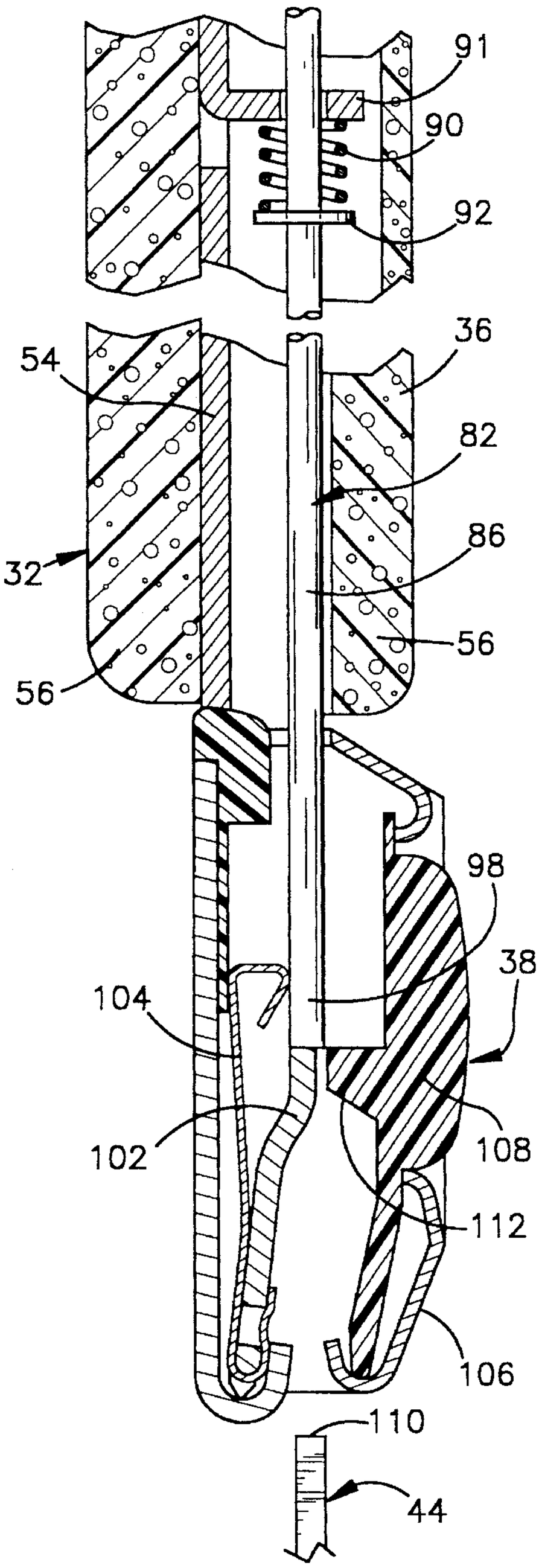
91
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Fig.6

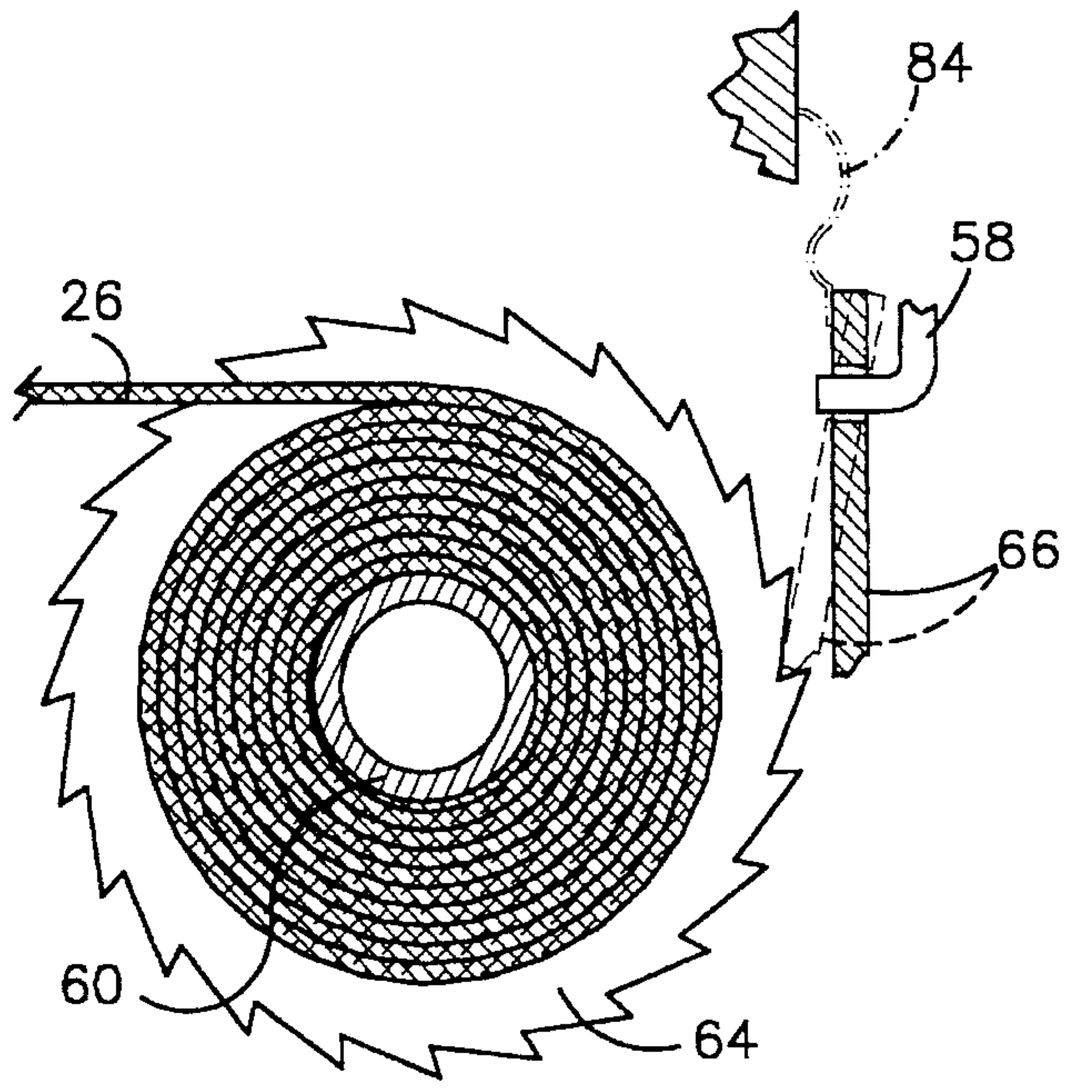
84
58
26
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Fig.7

CHILD RESTRAINT SYSTEM

FIELD OF THE INVENTION

The present invention relates to a child restraint system, and more particularly, to a child restraint system having shoulder belts which are connected to an abdomen shield.

BACKGROUND OF THE INVENTION

A known child restraint system is disclosed in U.S. Pat. No. 4,762,369. This child restraint system includes a pair of shoulder belts which are connected with the back of a seat for the child. The shoulder belts are also connected with an abdomen shield. The abdomen shield is connected with a base of the seat by a buckle. An apparatus for adjusting the length of the shoulder belts is disposed within the abdomen shield.

SUMMARY OF THE INVENTION

An improved apparatus for restraining a child seated in a vehicle includes shoulder belts which engage the shoulders of the child and a shield which engages the abdomen of the child. The abdomen shield is connected with a base by a buckle. The shoulder belts are connected with belt retractors mounted on the abdomen shield. Upon movement of the abdomen shield away from the child, the shoulder belts are extended from the retractors. Upon movement of the abdomen shield toward the child, the shoulder belts are retracted by the retractors.

The shoulder belt retractors include spools upon which the shoulder belts are wound during retraction of the shoulder belts and from which the shoulder belts are unwound during extension of the shoulder belts. Latches are operated from a disengaged condition to an engaged condition to block extension of the shoulder belts when the abdomen shield is buckled to the base. Upon unbuckling of the shield from the base, the latches are disengaged to allow the shoulder belts to be extended.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other features of the present invention will become more apparent to those skilled in the art upon reading the following description of a preferred embodiment of the invention in view of the accompanying drawings, wherein:

FIG. **1** is a schematic side elevational view depicting the relationship of a child restraint system to a vehicle seat;

FIG. **2** is a front elevational view, taken generally along the line **2—2** of FIG. **1**, further illustrating the child restraint system;

FIG. **3** is an enlarged and partially broken away view of a portion of the child restraint system;

FIG. **4** is an enlarged fragmentary view of a portion of FIG. **3**;

FIG. **5** is an enlarged fragmentary view similar to FIG. **4**;

FIG. **6** is a sectional view illustrating the relationship of a buckle assembly to a tongue in the child restraint system, the buckle assembly and tongue being shown in a disengaged condition; and

FIG. **7** is a schematic sectional view, taken generally along the line **7—7** of FIG. **3**.

DESCRIPTION OF A PREFERRED EMBODIMENT

An apparatus **10** (FIG. **1**) for restraining a child **12** in a vehicle includes a child seat **14**. The child's seat **14** is supported on a vehicle seat. The child's seat **14** has a base **16** upon which the child **12** sits. A back **20** extends upward from the base **16**.

A restraining system **24** constructed in accordance with the present invention is connected with the seat **14**. The restraining system **24** includes a shoulder belt **26** (FIG. **2**) which engages the right shoulder of the child **12**. The restraining system **24** also includes a shoulder belt **28** which engages the left shoulder of the child. Upper ends of the shoulder belts **26** and **28** are connected with the back **20** of the seat **14**.

A padded abdomen shield **32** engages the abdomen of the child **12** (FIG. **1**). The abdomen shield **32** includes a main section **34** (FIG. **2**) which is connected with the shoulder belts **26** and **28** and extends across the abdomen of the child **12**. A connector section **36** extends downward from the main section **34**. The connector section **36** includes a buckle **38** fixedly connected to the connector section **38**.

The buckle **38** receives a tongue **44** (FIG. **2**). The tongue **44** is connected with an anchor strap **40** which is connected with the base **16**. The buckle **38** includes parts to be described below for latching the tongue **44** to the buckle **38**. When the tongue **44** is latched to the buckle **38**, the abdomen shield **32** is connected to the base **16**.

The buckle **38** includes a latch member **102** (FIG. **6**) which is urged into the position shown in FIG. **6** by a latch spring **104**. The latch spring **104** and latch member **102** are enclosed by a buckle housing **106**. An opening (shown in FIG. **5**) in the tongue **44** is engaged by the latch member **102** to hold the tongue in the buckle **38**. A pushbutton **108** is manually depressed to depress the latch member **102** against the influence of latch spring **104** to release the tongue **44**. Depressing the pushbutton **108** moves a projection **112** on the pushbutton into engagement with the latch member **102**. As the pushbutton **108** is further depressed, the projection **112** moves the latch member **102** out of engagement with the opening in the tongue **44** to release the tongue.

A pair of retractor assemblies **50** and **52** (FIG. **3**) are mounted in the abdomen shield **32**. The retractor assemblies **50** and **52** are mounted in a spaced apart relationship on a metal base plate **54** of the abdomen shield **32**. The base plate **54** and retractor assemblies **50** and **52** are enclosed by padding **56** (FIG. **6**). The padding **56** is cut away in FIGS. **3**, **4** and **5** to illustrate the retractor assemblies **50** and **52**. The shoulder belt **26** is extendable from and retractable into the retractor assembly **50**. The shoulder belt **28** is extendable from and retractable into the retractor assembly **52**.

The retractor assembly **50** (FIG. **3**) includes a frame **58** which is fixedly attached to the base plate **54** of the abdomen shield **32**. A spool **60** is rotatably mounted in the frame **58**. The shoulder belt **26** is attached to the spool **60** and may be wound on and unwound from spool **60**. A spring assembly **62** is connected to the left (as viewed in FIG. **3**) end of the frame **58**. The spring assembly **62** includes a spiral coil spring having an inner end portion connected with the spool **60** and an outer end portion connected with the frame **58**. The spiral coil spring biases the spool **60** in a belt winding direction.

A ratchet wheel **64** is fixedly connected with the right (as viewed in FIG. **3**) end of the spool **60**. A latch pawl **66** (FIGS. **3** and **5**) is pivotally mounted on the frame **58** (FIG.

3). The latch pawl **66** is movable between a disengaged position, shown in solid lines in FIG. **7**, in which the latch pawl is spaced from the ratchet wheel **64**, and an engaged position, shown in dashed lines in FIG. **7**, in which the latch pawl engages the ratchet wheel. When the latch pawl **66** is in the engaged position, the latch pawl blocks rotation of the spool **60** in a shoulder belt extending (unwinding) direction, that is, in a counterclockwise direction as viewed in FIG. **7**.

The retractor assembly **52** (FIG. **3**) has the same construction as the retractor assembly **50**. Thus, the retractor assembly **52** includes a frame **68** fixedly attached to the base plate **54** of the abdomen shield **32** and upon which a spool **70** is rotatably mounted. A spring assembly **72** is mounted on the frame **68**. The spring assembly **72** includes a spiral coil spring enclosed in a housing. An inner end portion of the spiral coil spring is connected with the spool **70** and an outer end portion of the coil spring is connected with the frame **68**. The coil spring biases the spool **70** in a belt winding direction. The spools **60** and **70** are supported by the frames **58** and **68** for rotation about axes which are skewed relative to each other.

A ratchet wheel **74** is fixedly connected with an end of the spool **70** opposite from the coil spring assembly **72**. A latch pawl **76** is movable between a disengaged position in which it is spaced from the ratchet wheel **74** and an engaged position in which the latch pawl engages the ratchet wheel. When the latch pawl **76** is in the engaged position, the latch pawl blocks rotation of the spool **70** in a direction in which the shoulder belt **28** is extended.

The latch pawls **66** and **76** engage the ratchet wheels **64** and **74** to prevent extension (unwinding) of the shoulder belts **26** and **28** in the same manner. Although it is preferred to prevent extension of the shoulder belts **26** and **28** by engaging the ratchet wheels **64** and **74** with the latch pawls **66** and **76**, extension of the shoulder belts **26** and **28** could be prevented in a different manner if desired. For example, clamp assemblies could be provided to grip the shoulder belts **26** and **28**.

An actuator assembly **82** (FIG. **3**) is operable to move the latch pawls **66** and **76** from their disengaged positions to their engaged positions in response to connection of the buckle **38** with the tongue **44**. Thus, prior to connection of the buckle **38** with the tongue **44**, the latch pawls **66** and **76** are in their disengaged positions. When the latch pawls **66** and **76** are in their disengaged positions, the shoulder belt spools **60** and **70** are rotatable in either a clockwise or counterclockwise direction relative to the frames **58** and **68**. Upon connection of the buckle **38** with the tongue **44**, the actuator assembly **82** (FIG. **3**) effects movement of the latch pawls **66** and **76** to their engaged positions.

The actuator assembly **82** includes a pair of latch pawl springs **84** and **85** (FIG. **3**) which urge the latch pawls **66** and **76** toward their engaged positions. The latch pawl spring **84** is a wire spring. The latch pawl spring **85** has the same construction as the latch pawl spring **84**. The latch pawl spring **84** is shown schematically in FIG. **7** in dot-dash lines biasing pawl **66** into the dashed line position shown in FIG. **7**.

The actuator assembly **82** also includes a cylindrical actuator rod **86** (FIG. **3**). The actuator rod **86** has a cylindrical head end portion **88** of a greater diameter than the remaining portion of the actuator rod **86**. A lower end portion **98** of the actuator rod **86** is received in the buckle **38** (FIG. **6**).

The actuator assembly **82** also includes a release spring **90**. The release spring **90** has a helical configuration and encircles the actuator rod **86**. The release spring **90** engages a portion **91** of the base plate **54** and a stop element **92** secured to the actuator rod **86**. The release spring **90** is relatively strong, i.e., stronger than the latch pawl springs **84** and **85** together. The actuator rod **86** is urged axially downward into the buckle **38** (as viewed in FIGS. **3–5**) by the release spring **90**.

When a child **12** is to be positioned in the seat **14** (FIG. **1**), the buckle assembly **38** is disengaged from the tongue **44**. At this time, the actuator rod **86** is urged downward by the release spring **90** (FIG. **5**). The head portion **88** of the actuator rod **86** engages the latch pawls **66** and **76** and the release spring **90** overcomes the latch pawl springs **84** and **85**. Thus, the latch pawls **66** and **76** are held out of engagement with the ratchet wheels **64** and **74** by the head end portion **88** of the actuator rod **86**. Therefore, the abdomen shield **32** can be readily moved away from the back **20** (FIG. **1**) of the seat **14** to extend the shoulder belts **26** and **28** to facilitate positioning the child on the seat **14**.

As the shoulder belts **26** and **28** are extended, the spools **60** and **70** are rotated relative to the frames **58** and **60** of the retractors and the shoulder belts are unwound from the spools. Once the child **12** has been positioned on the seat **14**, the abdomen shield **32** is moved toward the back **20** of the seat and the abdomen of the child. As this occurs, the spring assemblies **62** and **72** rotate the spools **60** and **70** to retract the shoulder belts **26** and **28** by winding them onto the spools.

Once the abdomen shield **32** has been properly positioned relative to the abdomen of the child **12**, the tongue **44** is inserted into the buckle **38** to connect the abdomen shield with the anchor strap **40** and base **16** of the seat **14**. As the tongue **44** is inserted into the buckle **38**, a leading end **110** (FIG. **6**) of the tongue **44** moves the actuator rod **86** upward to move the head end portion **88** of the actuator rod out of engagement with the latch pawls **66** and **76** (FIGS. **3** and **4**). This enables the latch pawl springs **84** and **85** to move latch pawls **66** and **76** into engagement with the ratchet wheels **64** and **74** to block further extension of the shoulder belts **26** and **28**. However, the spools **60** and **70** can still be rotated by the spring assemblies **62** and **72** in a direction to retract the shoulder belts **26** and **28** by winding them onto the spools.

A backup lock spring **94** and a washer **97** encircle the actuator rod **86**. The backup lock spring **94** has a helical configuration. The backup lock spring **94** is disposed between a stop **96** which is secured to the actuator rod **86** and the washer **97** which is slidable along the actuator rod **86**. If the latch pawl springs **84** and **85** fail to move the latch pawls **66** and **76** into engagement with the ratchet wheels **64** and **74** as the tongue **44** is inserted into the buckle **38**, the washer **97** will engage the latch pawls **66** and **76** and move the latch pawls into engagement with the ratchet wheels.

An indicator system **128** is provided to indicate when the latch pawls **66** and **76** are in their engaged positions blocking extension of the shoulder belts **26** and **28**. The indicator system **128** includes an opening **132** (FIG. **3**) formed in the connector section **36** of the abdomen shield **32**. Indicia **134** is provided on the actuator rod **86**. The indicia **134** is visible at the opening **132** when the actuator rod **86** has been moved upward (as viewed in FIGS. **3** and **4**) by insertion of the tongue **44** into the buckle **38**. As the tongue **44** is inserted into the buckle **38** and the actuator rod **86** is moved upward, the indicia **134** moves upward into a position in which it is visible at the opening **132**. As this occurs, the latch member **102** moves into engagement with the opening in the tongue

44 to securely hold the tongue in the buckle **38**. At this time, the indica **134** indicates that the tongue **44** and the buckle **38** have been interconnected.

As described above, when the pushbutton **108** is depressed, the tongue **44** is released from the latch member **102**. The actuator rod **86** then moves downward (as viewed in FIG. **6**) under the influence of release spring **90** to partially eject the tongue **44** (FIG. **4**) from the housing **106**. When the tongue **44** is removed from the buckle **38**, the actuator rod **86** moves downward (as viewed in FIGS. **3–5**) and the indicia **134** is no longer visible at the opening **132**.

From the above description of the invention, those skilled in the art will perceive improvements, changes and modifications. Such improvements, changes and modifications within the skill of the art are intended to be covered by the appended claims.

Having described the invention, the following is claimed:

1. An apparatus for restraining a child seated in a vehicle, said apparatus comprising:

shoulder belts for engaging the shoulders of the child seated in the vehicle;

shield means for engaging the abdomen of the child seated in the vehicle; and

shoulder belt retractor means mounted on said shield means and connected with said shoulder belts for enabling the shoulder belts to be extended upon movement of said shield means away from the abdomen of the child seated in the vehicle and for retracting the shoulder belts upon movement of said shield means toward the abdomen of the child seated in the vehicle;

said shoulder belt retractor means including a first rotatable spool upon which at least one of said shoulder belts is wound during retraction of said one shoulder belt and from which said one shoulder belt is unwound during extension of said one shoulder belt.

2. An apparatus as set forth in claim **1** wherein said shoulder belt retractor means includes a second rotatable spool upon which a second one of said shoulder belts is wound during retraction of said second shoulder belt and from which said second shoulder belt is unwound during extension of said second shoulder belt.

3. An apparatus as set forth in claim **2** wherein said retractor means includes a first latch member which is movable between an engaged condition in which said first latch member blocks rotation of said first spool and a disengaged condition in which said first latch member is ineffective to block rotation of said first spool and a second latch member which is movable between an engaged condition in which said second latch member blocks rotation of said second spool and a disengaged condition in which said second latch member is ineffective to block rotation of said second spool.

4. An apparatus as set forth in claim **3** further including a base, buckle means for interconnecting said shield means and said base, said buckle means being operable between a first condition connecting said shield means with said base and a second condition in which said buckle means is ineffective to connect said shield means with said base, and actuator means for moving said first and second latch members from the disengaged condition to the engaged condition upon operation of said buckle means from the second condition to the first condition.

5. An apparatus as set forth in claim **4** further including indicator means for indicating when said first and second latch members are in the engaged condition.

6. An apparatus as set forth in claim **2** wherein said first spool is rotatable about a first axis and said second spool is rotatable about a second axis which is skewed relative to said first axis.

7. An apparatus for restraining a child seated in a vehicle, said apparatus comprising:

a base;

shoulder belts connected with said base for engaging the shoulders of the child seated in the vehicle;

shield means for engaging the abdomen of the child seated in the vehicle;

retractor means mounted on said shield means and including a spool connected with said shoulder belts and being rotatable in a withdrawal direction for enabling the shoulder belts to be extended upon movement of said shield means away from the abdomen of the child seated in the vehicle and said Spool biased to rotate in a retraction direction for retracting said shoulder belts upon movement of said shield means toward the abdomen of the child seated in the vehicle;

belt restraining means mounted on said shield means and operable between an engaged condition preventing extension of said shoulder belts from said retractor means and a disengaged condition in which said belt restraining means is ineffective to prevent extension of said shoulder belts by said retractor means;

means for interconnecting said shield means and said base, said means including a buckle and a tongue latchable in said buckle to connect said shield means with said base; and

actuator means for operating said belt restraining means from the disengaged condition to the engaged condition upon latching of said tongue in said buckle.

8. An apparatus as set forth in claim **7** further including indicator means for indicating when said tongue is latched in said buckle.

9. An apparatus as set forth in claim **7** wherein said shield means includes a main section in which said retractor means is mounted and a connector section which extends from said main section, said buckle being connected with said connector section of said shield means and said tongue being connected with said base.

10. An apparatus as set forth in claim **7** wherein said retractor means includes a first retractor assembly disposed in a first portion of said shield means and a second retractor assembly disposed in a second portion of said shield means, said actuator means being at least partially disposed between said first and second portions of said shield means.

11. An apparatus as set forth in claim **10** wherein said first retractor assembly includes a first spool around which a first one of said shoulder belts is wound during retraction of the first shoulder belt and from which said first shoulder belt is unwound during extension of the first shoulder belt, said second retractor assembly including a second spool around which a second one of said shoulder belts is wound during retraction of the second shoulder belt and from which the second shoulder belt is unwound during extension of the second shoulder belt.

12. An apparatus for restraining a child seated in a vehicle, said apparatus comprising:

first and second shoulder belts for engaging the shoulders of the child seated in the vehicle;

shield means for engaging the abdomen of the child seated in the vehicle; and

shoulder belt retractor means mounted on said shield means and including a spool connected with said shoulder belts and being rotatable in a withdrawal

direction for enabling the shoulder belts to be extended upon movement of said shield means away from the abdomen of the child seated in the vehicle and said spool biased to rotate in a retraction direction for retracting the shoulder belts upon movement of said shield means toward the abdomen of the child seated in the vehicle;

said retractor means including a first retractor assembly mounted in a first portion of said shield means, said first shoulder belt being retractable into and extendable from said first retractor assembly, and a second retractor assembly mounted in a second portion of said shield means and spaced from said first retractor assembly, said second shoulder belt being retractable into and extendable from said second retractor assembly.

13. An apparatus as set forth in claim **12** wherein said first retractor assembly includes a first means for effecting operation of said first retractor assembly to retract the first shoulder belt into said shield means, said second retractor assembly includes a second means for effecting operation of said second retractor assembly to retract the second shoulder belt into said shield means.

14. An apparatus as set forth in claim **12** wherein said first retractor assembly includes first belt restraining means operable between an engaged condition blocking extension of said first shoulder belt and a disengaged condition in which said first belt restraining means is ineffective to block extension of said first shoulder belt, said second retractor assembly including second belt restraining means operable between an engaged condition blocking extension of said first shoulder belt and a disengaged condition in which said second belt restraining means is ineffective to block extension of said second shoulder belt, a base, buckle means for interconnecting said shield means and said base, said buckle means being operable between a first condition connecting said shield means with said base and a second condition in which said buckle means is ineffective to connect said shield means with said base, and actuator means extending between said buckle means and said first and second belt restraining means for operating said first and second belt restraining means from the disengaged condition to the engaged condition upon operation of said buckle means from the second condition to the first condition.

* * * * *